

REMARKS

Claims 1-31 remain in the application as originally submitted.

The specification is amended to correct a typographical error noted by the Examiner. No other errors were discovered in the specification during the undersigned's review in preparation of this Response. The Examiner's attention to such detail is appreciated.

Claims 1-31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Watanabe et al. Applicant disagrees and requests reconsideration.

The Examiner is reminded that the application must be reviewed in accordance with 35 U.S.C. §112 as Applicant "regards" its invention. How an Applicant regards its invention is in the manner which Applicant claims the invention. Accordingly, the Examiner needs to consider the obviousness inquiry in the context of Applicant's specific claims, and not in any manner which the Examiner might regard the Applicant's invention apart from the literal claims.

The Examiner asserts that Watanabe et al. discloses a capacitor having a high k capacitor region with three layers of metal oxides of varying stoichiometric potential, and that as such, Watanabe et al. describes various elements and combinations of elements that could be used to arrive at Applicant's various claims. Yet, each of Applicant's claims inherently recites separately what Applicant regards as its invention. And, Applicant's instant

claims are in no way of a breadth which covers all high k metal oxide regions only having some varying stoichiometric potential therein. Rather, each of Applicant's claims are expressly directed to specific attributes which are neither shown nor suggested by Watanabe et al., as further pointed out below.

The Examiner is also reminded that when applying 35 U.S.C. §103, the claimed invention must be considered as a whole, and any applied reference must likewise be considered as a whole. MPEP §2141. Further, in determining the differences between the prior art and the claims, the question under 35 U.S.C. §103 is not whether differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. MPEP §2141.02. In addition, a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. MPEP §2141.02. Also, there must be some suggestion or motivation to modify a reference to arrive at the Applicant's claim, and none is seen in Watanabe et al. MPEP §2143.01.

More specifically, Applicant's independent claim 1 combination includes a high k capacitor dielectric region of metal oxide having multiple different metals bonded with oxygen and having varying stoichiometry across its thickness. Yet, further included in the claim 1 combination is recitation that the layer comprise an inner region, a middle region and an outer region, where the middle region has a different stoichiometry than both the inner and outer regions. This is neither shown nor suggested by Watanabe et al.

While Watanabe et al. might be considered as disclosing inner, middle and outer regions, each of its examples specifically referring to the same provide the middle region to have the same stoichiometry as at least one of the inner and outer regions. (IEC Table 1, and the language pertaining thereto). The other reference in Watanabe et al. with regard to varying stoichiometry is that the proportion of one of the elements varies in one direction in the oxide through the depth of the stacked layers, thereby providing an apparent continual gradient from one elevation of the capacitor dielectric region to the other. (col.4, lns.27-39).

Yet, none of this is what Applicant recites in claim 1. Further, the reference in no way discloses or suggests what Applicant recites in claim 1. To arrive at the modification which the Examiner would make in finding claim 1 obvious requires hindsight reconstruction, which is impermissible. Alternately considered, to arrive at the conclusion of obviousness which the Examiner makes results in a fundamental modification of the reference teachings, with there being no such motivation for such modification in the reference. Applicant is not merely claiming varying stoichiometry in a high k capacitor dielectric region, but rather a specific relationship in the claim 1 combination. As this relationship is not shown nor suggested by Watanabe et al., independent claim 1 should be allowed, and action to that end is requested.

The independent claim 5 combination recites that one or more metals in the subject combination when bonded with oxygen has a first current leakage potential, and another of the metals when bonded with oxygen has a second current leakage potential which is greater than the first current leakage potential. The dielectric region layer comprises at least one portion having a greater concentration of the one metal bonded with oxygen which is more proximate at least one of the first and second electrodes than another portion more proximate a center of the layer. Watanabe et al. says absolutely nothing about one metal when bonded with oxygen as compared to another metal when bonded with oxygen having an effect on the magnitude of current leakage potential. Accordingly, it teaches nothing in this regard, and therefore, certainly does not teach or suggest anything other than positioning some portion having a greater concentration of any metal more proximate at least one of a first and second electrode than another portion more proximate a center of the layer.

Although Watanabe et al. does teach an apparent gradient in stoichiometry difference from one side of the region to another side in stepped stoichiometry differences between middle and outer regions in Table 1, it in no way discloses or suggests the specific relationship which Applicant recites in the independent claim 5 combination. Again, such can only come from hindsight reconstruction, or reading a modification into the reference which the

reference does not motivate. Accordingly, independent claim 5 should be allowed, and action to that end is requested.

The independent claim 12 combination should be allowed essentially for the same reasons argued above with respect to claim 5. In differing from claim 5, claim 12 talks about the absence of one metal in the oxide creating a vacancy, with the lack of vacancy in a second material of the layer having a second current leakage potential which is greater than the first leakage potential created by the vacancy. The claim 12 combination further recites that the high k capacitor dielectric region layer comprises at least one portion having a greater concentration of the first material which is more proximate at least one of the first and second electrodes than another portion more proximate a center of the layer. The arguments provided above regarding claim 5 equally apply to claim 12 with respect to the subject portions as affecting current leakage potential, here by creating a vacancy. Accordingly, independent claim 12 should be allowed, and action to that end is requested.

Applicant's independent claim 18 combination recites that the high k capacitor dielectric region includes a situation where one of the metals when bonded with oxygen has a first dielectric constant, and wherein another of the metals when bonded with oxygen has a second dielectric constant which is less than the first dielectric constant. The combination further includes that the layer comprises at least one portion having a greater concentration of the one metal bonded with oxygen more proximate a center of the layer than

another portion more proximate than either of the first and second electrodes. Under no stretch of the imagination could Watanabe et al. be concluded to render this claim obvious. Watanabe et al. only teaches, in one aspect, a continuous direction gradient from one electrode to another, and in the Table 1 embodiments, a center region which is the same in stoichiometry composition as at least one of the regions adjacent the electrode.

On the other hand, Applicant's claim 18 recites that the subject one portion has a greater concentration of the one metal bonded with oxygen which is more proximate a center of a layer than another portion more proximate either of the first and second electrodes. Again, the only way an obviousness conclusion of Applicant's claim can be arrived at is by hindsight reconstruction, or by modifying the reference in a manner not motivated by it. Accordingly, independent claim 18 should be allowed, and action to that end is requested.

Independent claim 25 should be allowed for essentially the same reasons argued above with respect to independent claim 18. Such also recites, in the combination, a layer comprising at least one portion having a greater concentration of a first material which is more proximate a center of a layer than another portion more proximate either of the first and second electrodes, where the first material and second material relationship is relative to an absence of one metal in the oxide creating a vacancy. For essentially


the same reasons as argued above with respect to claim 18, independent claim 25 should be allowed, and action to that end is requested.

Each of Applicant's dependent claims should be allowed as depending from allowable base claims, and for their own recited features which are neither shown nor suggested in the cited art.

This application is believed to be in immediate condition for allowance, and action to that end is requested. If the Examiner's next anticipated action is to be anything other than a Notice of Allowance, the undersigned respectfully requests a telephone interview prior to issuance of any such subsequent action.

Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Filing Date August 30, 1999
Inventor Vishnu K. Agarwal et al.
Assignee Micron Technology, Inc.
Group Art Unit 2815
Examiner J. Fenty
Attorney's Docket No. MI22-1196
Title: Capacitors Having a Capacitor Dielectric Layer Comprising a Metal Oxide
Having Multiple Different Metals Bonded With Oxygen

MARKED-UP SPECIFICATION PARAGRAPHS
ACCOMPANYING RESPONSE TO DECEMBER 20, 2000 OFFICE ACTION

To: Assistant Commissioner for Patents
Washington, D.C. 20231

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The replacement specification paragraphs incorporate the following amendments the last paragraph on page 6, beginning at line 15 and ending at page 7, line 2. Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

A high k capacitor dielectric region 35 is positioned between first capacitor electrode 24 and second capacitor electrode 26. Capacitor dielectric region ~~34~~ 35 comprises a layer of metal oxide having multiple different metals bonded with oxygen, for example those materials described above. Most preferably and as shown, capacitor dielectric region 35 consists essentially of

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such layer, meaning no other layers are received intermediate first electrode 24 and second electrode 26 which meaningfully impact the operation or capacitance of capacitor 32. In accordance with but one aspect of the invention, the metal oxide layer having multiple different metals bonded with oxygen has varying stoichiometry across its thickness. In other words, the stoichiometry in such layer is not substantially constant throughout the layer.